

REMARKS

The below-named representatives and Robert Benson, representative of the assignee of the entire interest, thank the Examiner for the courtesy of an in-person interview conducted on December 15, 2005. The present response addresses substantive points discussed during the interview, although no agreement was reached. Thus, the present response is believed to constitute a complete written statement of the reasons presented in the interview as warranting favorable action, as required by 37 C.F.R. §1.133.

Applicants have amended independent claims 1, 56, 97, and 110 to clarify that the semiconductor nanowires are each made by a process that is recited in each respective claim. These amendments are made solely for purposes of clarity, as discussed below.

Additionally, Applicants have amended the independent claims to specify the relationship between the semiconductor nanowires. Support for this amendment can be found in the specification, for example, on page 77, line 24 to page 78, line 42, or Fig. 28. Accordingly, no new matter has been added. See below for discussion.

Claims 2, 47, and 118-120 have been amended to provide antecedent basis. Claims 62-67 have been deleted without prejudice.

Claims 1-31, 38-47, 49-61, 68-72, 75, 76, 97, 98, 102-105, 109-111, 113-116, 118-201, 261, 262, and 374-377 are now pending in the application. Claims 3, 4, 9-31, 49-55, 102-105, 109, 111, 113-116, 121-174, 176-180, 182, 184, 185, 190, 192, 193, 196-201, 261, and 262 remain withdrawn. Claims 1, 2, 5-8, 38-47, 56-61, 68-72, 75, 76, 97, 98, 110, 118-120, 175, 181, 183, 186-189, 191, 194, 195, and 374-377 are now active.

Overview

In general, the Patent Office appears to take the following positions in the latest Office Action:

- (1) The Patent Office contends certain claims written in product-by-process format will not be interpreted as such because the language of those claims does not clearly trigger product-by-process interpretation.

(2) The Patent Office contends that the process steps of a product-by-process recitation should be given no patentable weight, or that the product-by-process recitations of the rejected claims would result in product no different from the prior art.

(3) The Patent Office contends that (a) any product-by-process recitations of the rejected claims that would result in product with better uniformity than that of the prior art, or (b) other, non-product-by-process claims which recite better nanowire uniformity than that of the prior art, would be obvious, because the prior art would have had such uniformity as a goal, even if only implicitly stated. In other words, a speculated goal of producing a particular article, even if no methods currently exist of achieving that goal, renders obvious a later invention embodied in that article.

(4) The Patent Office contends that the claims do not recite sufficient structural interrelationship of components to properly define a device as claimed.

The Applicants respectfully disagree with these positions, and respond to each of these as follows:

(1) Although it is believed that all of the claims (prior to amendment herein) that include product-by-process limitations are clear in view of the case law concerning product-by-process claims, the Applicants have amended the claims to further clarify these aspects. These amendments are made solely for purposes of clarity, and do not limit the claims in any way.

(2) The Applicants disagree with what appears to be the Examiner's interpretation of the law in this regard. The law in this regard as currently interpreted by the Patent Office is as follows: a product-by-process claim is limited to the product produced by the process recited in the claim. If that claimed product, based upon the process of its production, is different from any product in the prior art, then that claim is not anticipated by the prior art, and differences between the product, as claimed, and the prior art are analyzed under the standard principles of 35 U.S.C. §103 (i.e., obviousness). The Patent Office thus is not free to ignore process recitations of a product-by-process claim when the resultant claimed product is not anticipated by a product in the prior art.

(3) The devices as claimed, including good uniformity of nanowire diameter, which is believed not to be obtainable by the prior art of record, as a product itself, is believed by the Applicants to be non-obvious in view of the art. The Examiner's position appears to be that the prior art (e.g., in the form of schematic drawings of the Kuekes reference, discussed below) presents

a goal of making uniform nanowires, therefore the first inventors to have attained this goal have simply made an obvious improvement, and are not entitled to such a claim. This position is simply unfounded in the law. If the law is that a goal of producing a particular article, even if no methods presently exist of reaching that goal and producing that particular article, renders obvious later attainment of such an article, then a very large number of valid patents would be struck down.

(4) Although the Applicants disagree with the Examiner's contention in this regard and do not concede to its accuracy, amendments have been made to more clearly recite a structural/functional relationship between the nanowires. However, Applicants respectfully maintain that the clarity of the claims are to be assessed under the principles of 35 U.S.C. §112, ¶2, namely, would those of ordinary skill in the art clearly understand what is being claimed.

Finally, in summary, on the basis of the December 15, 2005 interview, it is believed that the Examiner feels method claims carrying the process recitation of the instant product-by-process claims might be patentable. If this is the case, then to the extent products produced by these process recitations are different from the prior art, it is believed they should themselves be patentable. The Examiner has provided no evidence that the products produced such process recitations are not different from the prior art, and it is contended that they are different, and thus patentable.

Claim Objections

Claims 1, 2, 5-8, 38-47, 56-72, 75, 76, 97, 98, 110, 118-120, 175, 181, 183, 186-189, 191, 194, 195, and 374-377 have been objected to for failing to define physical and/or positional relationships between the semiconductor nanowires.

Applicants do not concede to the correctness of these objections, as previously discussed. Applicants believe that these claims, prior to amendment herein, are clear to those of ordinary skill in the art, and note that a specific, defined functional relationship between the semiconductor nanowires has been positively recited, i.e., that the semiconductor nanowires are assembled together in electrical communication as a component of the electrical device. Applicants do not believe that the physical positions of each semiconductor nanowire within the device need to be positively recited within each claim in order to render the claim clear to those of ordinary skill in the art.

However, solely in the interest of advancing the patent application process, Applicants have elected to amend the independent claims to recite at least semiconductor nanowires, where a first

semiconductor nanowire of the at least three semiconductor nanowires defines an emitter of a transistor, a second semiconductor nanowire of the at least three semiconductor nanowires is in contact with the first semiconductor nanowire and defines a base of the transistor, and a third semiconductor nanowire of the at least three semiconductor nanowires is in contact with the second semiconductor nanowire and defines a collector of a transistor.

These claims have further been objected to for not clearly specifying “individual average diameter.” Applicants respectfully disagree, and note that the claims positively recite that the semiconductor nanowires are taken from a population of semiconductor nanowires having a variation in individual average diameter of “less than 20% *relative to each other* [emphasis added].” It is believed that this recitation makes clear that the average diameter recited is the average diameter of the nanowire, not the average diameter of a portion of the nanowire, as would be understood by a person of ordinary skill in the art, in reading this recitation.

Claims 2, 47, and 118-120 have been objected to for failing to clarify the relationship between the semiconductor nanowires. These claims have been amended to address these issues.

Claims 43-47 and 58-61 have been objected to for not adequately describing what length/diameter ratios should be present. Applicants are confused as to the nature of this objection. Applicants do not believe that that aspect ratio of each of the semiconductor nanowires need be recited within every claim, as the Patent Office would appear to imply. A claim is not a blueprint. If, however, the objection is that the specification does not teach that a nanowire can have the aspect ratios recited in those claims, Applicants respectfully direct the attention of the Examiner to page 36, lines 24-27, which states:

The aspect ratio, i.e., the ratio of semiconductor length to largest width, is greater than 2:1. In other embodiments, the aspect ratio may be greater than 4:1, greater than 10:1, greater than 100:1 or even greater than 1000:1.

Claim 62-67 have been objected to as claim 56 already recites that the largest cross section is less than 50 nm. Applicants have deleted claims 62-67.

In view of the above-described amendments and remarks, it is respectfully requested that the objection of the above claims be withdrawn.

Rejections under 35 U.S.C. §102(e)

Claims 1, 2, 5, 38-47, 56-72, 75, 76, 97-98, 110, 118-120, 175, 181, 183, 186-189, 191, 194, 195, and 374-377 have been rejected under 35 U.S.C. §112(e) as being anticipated by Kuekes, et al., U.S. Patent No. 6,559,468 (“Kuekes”).

Initially, Applicants do not concede that Kuekes is properly prior art to the Applicants' claimed inventions. Applicants reserve the right to establish invention dates for the claimed inventions that are on or before the effective 35 U.S.C. §102(e) date of Kuekes relied on in the Office Action.

It is believed that Kuekes does not provide a disclosure or a suggestion of a process for making nanowires having the size distributions recited in the claims, as amended, i.e., nanowires made using a process of selecting a population of catalyst colloid particles having a variation in diameter of less than 20% and growing a population of semiconductor nanowires catalytically from the catalyst colloid particles, or a device including at least three nanowires selected from a population of nanowires having a variation in diameter of less than about 20% relative to each other. Although the Patent Office points to Figs. 6 and 7 as evidence that Kuekes describes or suggests narrow variations in diameter, it should be noted that these are obviously mere schematic drawings, and should not be taken as literal disclosure of what was achieved or could be achieved by the techniques described by Kuekes. For example, the dotted lines illustrated in Fig. 7 should not be taken as a literal indication that some of the nanowires in Kuekes have been broken up into regular, isolated colinear fragments. Instead, it is respectfully submitted that the Patent Office, in formulating its rejection, should point to a description in Kuekes that teaches or at least suggests to one of ordinary skill in the art how to manufacture uniform diameter nanowires as recited in the instant claims, instead of relying on idealized schematic drawings.

Furthermore, Applicants believe that Kuekes, in fact, does not disclose or suggest any techniques for fabricating nanowires (let alone the uniform diameter nanowires recited in the claims), but merely points to other references for the manufacture of nanowires, for example, U.S. Pat. No. 6,459,095 (see col. 4, line 66 to col. 5, line 2 of Kuekes; see also col. 5, lines 11-16), Guo (*Appl. Phys. Lett.*, Vol. 71, p. 1881-1883; see col. 8, lines 36-39), Guo (*Science*, Vol. 275, p. 649-651; see col. 8, lines 39-42), or Tans (*Nature*, Vol. 393, p. 49-52; see col. 8, lines 42-44). However,

these references, even if properly forming part of the Kuekes specification, merely disclose known techniques such as lithography. For example, U.S. Pat. No. 6,459,095 recites that the wires “may be prepared using well-established art, including lithographic (optical ultraviolet, or electron beam) technologies,” (col. 6, lines 6-12) or that another “preparation produces single-crystal germanium nanowires of diameters *three to thirty nanometers*” (col. 6, lines 29-37, emphasis added), or that another technique “produces silicon wires that have diameters *in the range of 20 to 30 nanometers*, and lengths ranging from 1 to 20 micrometers” (col. 6, lines 38-45, emphasis added). Similarly, the Guo *Apl. Phys. Lett.* reference discloses nanoimprint lithography, while the Guo *Science* reference discloses electron beam lithography and reactive ion etching, and Tans refers to (but does not itself describe) molecular self-assembly techniques. No combination of these references is believed to anticipate via an enabling disclosure the devices recited in the instant claims, including size distributions, and other features resulting from process recitations of the claims (i.e., nanowires resulting from growth from a catalyst colloid particle).

Thus, it is believed that Kuekes is not applicable as a reference with respect to the uniform diameters recited in the claims, as Kuekes nowhere teaches or suggests to one of ordinary skill in the art how to make and use nanowires having the recited uniform diameters, and it is therefore respectfully requested that the rejection of these claims be withdrawn.

Rejections under 35 U.S.C. §103(a)

Claims 6 and 8 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Kuekes.

Claims 6 and 8 each indirectly depend from independent claim 1. For at least the reasons explained above with respect to the rejection under §102(e) in view of Kuekes, the premise of the rejection of claim 1 (that Kuekes enables all of the limitations of claim 1) is believed to be incorrect. Accordingly, while Applicants do not concede that there would have been any suggestion or motivation to make the modification suggested in the Office Action, the present rejection cannot stand, regardless. Thus, withdrawal of the rejection of claims 6 and 8 is respectfully requested.

Additionally, claims 1, 2, 5, 38-47, 56-72, 75, 76, 97, 98, 110, 118-120, 175, 181, 183, 186-189, 191, 194, 195, and 374-377 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Kuekes.

It should be noted that the Examiner's position appears to be that, even if the above position expressed by the Applicants were true, i.e., that following the disclosure of Kuekes would not result in a nanowire-containing device as recited in the instant claims, e.g. having the dimension distributions as claimed, that because Kuekes provides, inherently, a *goal* of making a uniform nanowire, Kuekes renders obvious any such claims. As previously described, it is believed that this is unfounded. Without direction as to how to attain such a goal, a device embodying that goal can not be obvious. Accordingly, Applicants respectfully submit that this reasoning is both flawed and not in accordance with the law.

CONCLUSION

In view of the foregoing amendments and remarks, this application should now be in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes, after the foregoing amendments and remarks, that the application is not in condition for allowance, the Examiner is requested to call the undersigned at the telephone number listed below.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicants hereby request any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

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Respectfully submitted,

By _____

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